A recent article in the Journal by Fenton et al. (1) reported largely negative findings for computer-aided detection (CAD)–enabled breast cancer screening (1). The study presents a potentially misleading analysis that involves measuring a screening center’s sensitivity to detecting breast cancer. The measurement used by Fenton et al. overestimates the sensitivity of screening the control populations relative to the sensitivity of CAD-enabled screening. A non–CAD-enabled screening center’s patients who had an undiagnosed malignant tumor that could have been identified by CAD but would otherwise eventually be diagnosed by subsequent rounds of non–CAD-enabled screening are counted as correctly noncancerous examinations when they should be counted as incorrectly noncancerous examinations. Correctly counting those cancers as false-negative results would degrade the measured sensitivity of the non–CAD-enabled centers (the control populations) and thus would demonstrate a greater benefit from CAD-enabled screening.

This evaluative problem may account for the study’s initially surprising assertion that the measured sensitivity of facilities that never implemented CAD is higher than the sensitivity of those centers using CAD technology.

To illustrate this point, consider the following example of the introduction of CAD that produces a beneficial increased yield of screen-detected tumors. The example screening center detects 800 malignant lesions annually by mammography. Furthermore, 200 patients who were screened are diagnosed with breast cancer annually, although they had a negative
mammogram. By the method described by Fenton et al. (1), the center’s sensitivity would be 800/(800 + 200) = 0.8 or 80%. Now consider what happens on the introduction of a CAD screening technology that provides a real benefit of yielding an additional 100 malignant lesions in its first year of operation. If those additional 100 CAD-detected tumors were from the population of patients who would not have had their tumor detected by another method, and instead those tumors would have been caught in a subsequent round of screening, then the sensitivity as computed by the method used by Fenton et al. (1) would be 900/(900 + 200) = 0.818 or 81.8%. Thus, despite a substantial and beneficial increased yield of malignant tumors of 12.5% in the first round of screening, the method used by Fenton et al. could register as little as a 1.8% increase in sensitivity in that same first round of screening. Given that CAD technologies for mammography are known to detect microcalcification deposits common in ductal carcinoma in situ (DCIS), it seems plausible that the introduction of a CAD system would be more likely to increase the detection of tumors that otherwise would have been caught in a subsequent round of screening (DCIS being a typically early-stage cancer).

It should be noted that Table 2 in Fenton et al. (1) indicates that the introduction of CAD technology resulted in a statistically significant increase in the percentage of malignant tumors that are preinvasive DCIS, as well as a statistically significant decline in the rate of detection of invasive cancers. Because preinvasive cancers generally have better prognostic characteristics than invasive malignancies, it appears as though the introduction of CAD technology had a beneficial impact by shifting the tumor yield toward preinvasive malignancies.

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Reference


Funding

The analysis was supported by the Canadian Breast Cancer Foundation.

Notes

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